

direction opposite to the moving direction of the mobile object, and each of the first and second image data is recorded with information indicating when the image data was sensed, said apparatus comprising:

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first retrieving means for retrieving the image data sensed at a first time instant from among a group of the first image data;

second retrieving means for retrieving the image data sensed at a second time instant, after a time corresponding to the known distance from the first time instant, from among a group of the second image data; and

synthesizing means for synthesizing the two retrieved image data to make panoramic image data.-.

REMARKS

Applicants request favorable reconsideration and allowance of this application in view of the foregoing amendments and the following remarks.

Claims 24-27 are pending in this application, with Claims 24 and 27 being independent. Claims 1-11 and 17 have been cancelled without prejudice.

Claim 24 has been amended and new Claim 27 has been added. Applicants submit that support for the amendments and the new claim can be found in the original disclosure, and therefore no new matter has been added.

Applicants submit that the rejections of Claims 1-11 and 17 are moot.

Claims 24-26 were rejected under 35.U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,236,748 (Iijima, et al.) in view of U.S. Patent No. 5,517,419

(Lanckton, et al.). Applicants respectfully traverse this rejection for the reasons discussed below.

Claim 24 has been amended, and Claim 27 has been drafted, to clarify the relationship between the positions and alignment of the recited first and second image sensing means. As recited in Claims 24 and 27, (i) the first and second image sensing means are arranged on a mobile object with a known distance between them in a moving direction of the mobile object and (ii) the first image sensing means is arranged to have an image sensing direction substantially aligned with the moving direction of the mobile object, while the second image sensing means is arranged to have an image sensing direction aligned with a direction opposite to the moving direction of the mobile object. Support for these features can be found, for example, at least in Fig. 8 of the original disclosure, which shows the relationship between camera 3 or 4 and camera 7.

The present invention recited in Claims 24 and 27 is directed to a method and apparatus for generating a panoramic image by synthesizing images sensed by first and second image sensing means arranged on a mobile object as discussed above. If a camera for sensing images substantially in the moving direction of the object and a camera for sensing images in a direction opposite to the moving direction are closely arranged, it is difficult to generate a high-quality panoramic image since the roof of the mobile object would be included in the images sensed by either the first or second image sensing means. To avoid such a problem, the present invention as recited in Claims 24 and 27 generates a panoramic image using image data from first and second image sensing means arranged separately with a known distance between them in a moving direction of the mobile object, by synthesizing first image data sensed by the first image sensing means at a first instant

with second image data sensed by the second image sensing means at a second time instant, after a time corresponding to the known distance from the first time instant. With these features, the difference in image sensing centers caused by the separation between the first and second image sensing means is compensated for, and a high-quality panoramic image can be generated.

Applicants respectfully submit that the cited art fails to disclose or suggest at least the above-mentioned features of Claims 24 and 27. Iijima, et al. discloses generating a panoramic image from a plurality of images obtained by pickup system 10L and 10R. However, as shown in Figs. 4 and 5A, for example, those image pickup systems are arranged to obtain images in substantially the same direction. Further, the image pickup systems are not arranged on a mobile object. Therefore, that patent does not disclose or suggest at least the above-mentioned features of Claims 24 and 27 and does not even address the problem that the present invention addresses.

Lanckton, et al. fails to remedy the above-mentioned deficiencies of Iijima, et al. Lanckton, et al. discloses arranging a plurality of cameras on a mobile object. However, that patent does not disclose or suggest generating a panoramic image by synthesizing an image sensed in a direction substantially aligned with the moving direction of the mobile object and an image sensed in the direction opposite to the moving direction. Instead, that patent only discloses analysis of images sensed by two cameras forming a stereo pair arranged on the same side of the mobile object to sense images in substantially the same direction. Moreover, that patent is directed to a terrain mapping system. Such a system is directed to analyzing key terrain features in images and correlating images to position data, and therefore it belongs to quite a different technical field than that of the

present invention or Iijima, et al. Therefore, Applicants also submit that there is no motivation to combine the teachings of the two patents.

For the foregoing reasons, Applicants submit that the cited art fails to disclose or suggest at least the above-mentioned features of Claims 24 and 27, whether the art is considered individually or in combination. Therefore, Applicants submit that those claims are patentable over the art of record.

The dependent claims recite additional features that further distinguish the present invention over the cited art. Further individual consideration of the dependent claims is requested.

In view of the foregoing, this application is believed to be in condition for allowance. Favorable reconsideration, entry of this Amendment After Final Rejection, withdrawal of the outstanding rejections, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our address given below.

Respectfully submitted,



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MARKED-UP VERSION SHOWING CHANGES MADE TO CLAIMS

24. (Amended) An image processing method for synthesizing first image data sensed by a first image sensing means with second image data sensed by a second image sensing means, wherein the first and second image sensing means are arranged separately on a mobile object with a known distance between them in the moving direction of the mobile object, the first image sensing means is arranged to have an image sensing direction substantially aligned with [a first] the moving direction of the mobile object, the second image sensing means is arranged to have an image sensing direction aligned with a [second] direction opposite to the moving direction of the mobile object [different from the first direction], and each of the first and second image data is recorded with information indicating when the image data was sensed, said method comprising the steps of:

retrieving image data sensed at a first time instant from among a group of the first image data;

retrieving image data sensed at a second time instant from among a group of the second image data, where the second time instant is a time occurring after the first instant by a time period corresponding to the known distance between the first image sensing means and the second image sensing means; and

synthesizing the image data retrieved at the first time instant and the second time instant to make panoramic image data.